PB87-145827

Environmental Methods Testing Site Project: Project Management Plan

Nevada Univ., Las Vegas

Jan 87

U.S. Department of Commerce
National Technical Information Service
NTIS

PB87-145827

EPA/600/4-86/047
January 1987

ENVIRONMENTAL METHODS TESTING SITE PROJECT
PROJECT MANAGEMENT PLAN

by

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Cooperative Agreement No. CR812189-01

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INFORMATION SERVICE
SPRINGFIELD, VA. 22161

TECHNICAL REPORT DATA (Please read Instructions on the reverse before completing)		
1. REPORT NO. EPA/600/4-86/047	2.	3. RECIPIENT'S ACCESSION NO. PB87 145827/AS
4. TITLE AND SUBTITLE ENVIRONMENTAL METHODS TESTING SITE PROJECT: Project Management Plan		5. REPORT DATE January 1987 6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) Charles K. Fitzsimmons		8. PERFORMING ORGANIZATION REPORT NO.
9. PERFORMING ORGANIZATION NAME AND ADDRESS Environmental Research Center University of Nevada, Las Vegas Las Vegas, Nevada 89154		10. PROGRAM ELEMENT NO. 11. CONTRACT/GRANT NO.
12. SPONSORING AGENCY NAME AND ADDRESS Environmental Monitoring Systems Laboratory-LV, NV Office of Research and Development U.S. Environmental Protection Agency Las Vegas, NV 89114		13. TYPE OF REPORT AND PERIOD COVERED Final Report 14. SPONSORING AGENCY CODE EPA/600/07
15. SUPPLEMENTARY NOTES		

16. ABSTRACT

The Environmental Methods Testing Site Project is being conducted by the Environmental Protection Agency with the cooperation of the state of Georgia, the state of Tennessee, Hamilton County, Tennessee, and the city of Chattanooga. The concept is to establish one well-characterized site at which to conduct a series of studies designed to improve environmental monitoring methods and methods for assessing human exposure to toxic substances in the environment. The project, planned to span a 5- to 15-year period, is being conducted in support of the Toxic Substances Control Act of 1976.

This management plan describes the objectives of the project and the interactions among the various participants that are necessary to complete the tasks of site selection, site characterization which includes inventorying data relevant to the Chattanooga area, designing a data base, and implementing the use of a geographic information system to analyze the data. The geographic information system will be used to analyze existing data to infer possible relationships among the elements of exposure mechanisms, and it will be used to plan studies needed to validate such relationships.

17. KEY WORDS AND DOCUMENT ANALYSIS		
a. DESCRIPTORS	b. IDENTIFIERS/OPEN ENDED TERMS	c. COSATI Field/Group
18. DISTRIBUTION STATEMENT RELEASE TO PUBLIC	19. SECURITY CLASS (This Report) UNCLASSIFIED	21. NO. OF PAGES 68
	20. SECURITY CLASS (This page) UNCLASSIFIED	22. PRICE

NOTICE

The information in this document has been funded wholly or in part by the United States Environmental Protection Agency under cooperative agreement number CR812189-01 to the Environmental Research Center, University of Nevada-Las Vegas. It has been subject to the Agency's peer and administrative review, and it has been approved for publication as an EPA document.

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The Environmental Methods Testing Site Project is being conducted by the Environmental Protection Agency with the cooperation of the state of Georgia, the state of Tennessee, Hamilton County, Tennessee, and the city of Chattanooga. The concept is to establish one well-characterized site at which to conduct a series of studies designed to improve environmental monitoring methods and methods for assessing human exposure to toxic substances in the environment. The project, planned to span a 5 to 15 year period, is being conducted in support of the Toxic Substances Control Act of 1976.

This management plan describes the objectives of the project and the interactions among the various participants that are necessary to complete the tasks of site selection, site characterization, and conducting field studies. Emphasis is given to site characterization which includes inventorying data relevant to the Chattanooga area, designing a data base, and implementing the use of a geographic information system to analyze the data. The geographic information system will be used to analyze existing data to infer possible relationships among the elements of exposure mechanisms, and it will be used to plan studies needed to validate such relationships.

Documentation of many of the technical details related to this project are reserved for future documents - the Data Management Procedures Plan, the Quality Assurance Plan, and the User's Guide - all listed as milestones in this management plan. Some of the details presently known are attached to this document as appendices.

This document was submitted in fulfillment of Cooperative Agreement No. CR 812189-01 by the Environmental Research Center under the sponsorship of the U.S. Environmental Protection Agency. This document covers a period from October 1, 1984, to January 31, 1986, and work was completed as of January 31, 1986.

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SECTION I

INTRODUCTION

This document has been written for EPA program office managers and management personnel of other agencies participating in the Environmental Methods Testing Site Project. It is meant to document and to clarify the policies for the project and the basic working relationships among project participants which were developed in the initial stages of the project. It is believed that these fundamental concepts will remain intact throughout the life of the project, but future revisions to the EMTS Project Management Plan may be desirable. Operational details for the project will be developed in separate documents which are provided for in this plan.

BACKGROUND

The Environmental Protection Agency (EPA) has a need to develop and to improve methods for assessing human exposure to toxic substances which are to support regulations resulting from The Toxic Substances Act of 1976. Having the responsibility for administering the Act, the EPA Office of Toxic Substances (OTS) has asked the EPA Office of Research and Development (ORD) for technical assistance. The Office of Acid Deposition, Environmental Monitoring, and Quality Assurance (ODEMQA) is that part of the Office of Research and Development which is responsible for monitoring methods development and validation and quality assurance support for the Environmental Protection Agency. The Environmental Methods Testing Site Project (EMTS) is being conducted by the Office of Research and Development through the ODEMQA laboratories for the Office of Toxic Substances. EMTS is a means to provide the research in the area of human exposure methods development needed by EPA.

CONCEPT

Field tests of monitoring equipment, survey techniques, or models for assessing exposure require that large amounts of data be collected usually at one or more selected sites. Much of the resources for such projects go into the preliminary work of selecting and characterizing a study site before the actual study can begin. The concept of the Environmental Monitoring

Testing Site (EMTS) is to perform the preliminary work once and then to proceed with any number of projects at the same, well-characterized site. Intrinsic to the concept is the establishment of a single testing site with the required supporting administrative structure, management team, information gathering services, computerized data management, quality assurance procedures, and assured cooperation of local authorities. This unique approach will provide a system of funding mechanisms, support agreements, and approvals. The EMTS will be a uniquely characterized city where a very large data base will be automated into a computerized, interactive, geographic information system. The only steps necessary to initiate field studies will be approval of the study plan and quality assurance plan by an appropriate review authority. The EMTS structure offers a considerable savings in costs and time to investigators contemplating field studies of exposure assessment methods.

Criteria used in identifying a suitable site for the EMTS included but were not limited to the following:

- o Assured permission and cooperation of local authorities.
- o Moderate climate enabling year round work.
- o A human population on the order of 450,000 to 1,100,000.
- o Relative isolation from other major pollution sources.
- o Existence of a variety of pollution sources.
- o Availability of existing relevant data on parameters important to exposure monitoring.
- o Availability of supporting facilities.

After considerable study of potential sites, the Chattanooga, TN, GA, Standard Metropolitan Statistical Area (SMSA) was chosen as the best site, based on criteria partially outlined above. The Chattanooga SMSA includes Hamilton, Marion, and Sequatchie Counties in Tennessee, and Catoosa, Dade, and Walker Counties in Georgia. Appendix D, Site Characteristics Document, describes the selection process and the study area in more detail.

Investigators from the EPA program offices, other Federal agencies, state and local departments, and international organizations interested in conducting studies to develop human exposure methods will be invited to use the site. Proposals will be reviewed by a steering committee consisting of members from the Office of Toxic Substances (OTS), the Office of

Research and Development (ORD), the State of Tennessee, Hamilton County, and the City of Chattanooga.

Some of the studies scheduled for implementation in 1986 are as follows:

HEAL (Human Exposure Assessment Location) - World Health Organization and EPA/ORD

National Human Monitoring Program - EPA Office of Toxic Substances

NHATS (National Human Adipose Tissue Survey)
NBN (National Blood Network)

OBJECTIVE

The objective of the Environmental Methods Testing Site Project is to provide a well-characterized site in which to develop, test, and compare multimedia exposure monitoring methodology. The emphasis is on characterizing one site in detail so that any number of exposure assessment studies can be conducted more economically and quickly than they could be conducted in separate cities.

OVERVIEW

In the remainder of this plan, a group of selected definitions are presented so that readers will have a common basis for understanding the terms employed. Management and funding information are summarized. Milestones are defined. Procedures for approving studies to be conducted at the EMTS are specified. Data management and analysis procedures are presented with special attention accorded to the planned geographic information system (GIS). Finally, a summary is provided of scheduled reports.

SECTION II

DEFINITIONS

Terms used repeatedly throughout this management plan are defined in this section to provide readers a common basis for understanding the discussions presented in following sections.

- ADABAS
  A relational data base management system, resident on the EPA IBM 3090/200 in Research Triangle Park, NC.

- ARC/INFO
  A geographic information system and a product of Environmental Systems Research Institute (ESRI), Redlands, CA. The ARC/INFO system performs functions in four categories: input, analysis, data management, and display and conversion. This software will be installed on a DEC VAX 11/785 computer in Las Vegas, NV.

- CLIENT
  The Office of Toxic Substances (OTS).

- dBASEIII
  A relational data base management system for the IBM personal microcomputer.

- DOSE
  The quantity of pollutant that enters the body.

- ENVIRONMENTAL METHODS TESTING SITE (EMTS)
  EMTS is the official name assigned to this project. EMTS also refers to the defined study area associated with this project. The study area was chosen by using well-developed site selection criteria and is defined as the Standard Metropolitan Statistical Area (SMSA) which encompasses the counties of Catoosa, Dade, and Walker in the state of Georgia, and Hamilton, Marion, and Sequatchie in the state of Tennessee.

- EMTS PROJECT
  An EPA-funded activity which provides, through the Office of Research and Development and its laboratories, a site, a data base, a data base management and analysis system, and a network of supporting funding and management agreements.

- EXPOSURE
  The event that a person comes into contact with the pollutant.

- GEOGRAPHIC INFORMATION SYSTEM (GIS)
  An automated data base system capable of manipulating geographic data and associating attribute data to cartographic features for computerized modeling. A GIS is designed for users who have needs to manage, analyze, and display map information.

- INFO
  A relational data base management system, a product of Henco Software, Inc. It is used by ARC/INFO as the data base manager. It is available for microcomputers as PC INFO.

- NATIONAL COMPUTER CENTER (NCC)
  EPA maintains a large computer facility at Research Triangle Park, NC, where data for national programs are stored. It is expected that the EMTS Project can make good use of this facility.

- PARTICIPANTS
  Participants are the various agencies and contractors performing tasks related to the EMTS Project. Participants to date are listed in alphabetical order as follows:

CEI	Combustion Engineering, Inc. (contractor)
C-HCAPCB	Chattanooga-Hamilton County Air Pollution Control Bureau
EMSL-LV	Environmental Monitoring Systems Laboratory-Las Vegas, EPA-ORD
EMSL-RTP	Environmental Monitoring Systems Laboratory-Research Triangle Park, EPA-ORD
ERC	Environmental Reseach Center, University of Nevada-Las Vegas (contractor)
GDEP	Georgia Division of Environmental Protection
LEMSCO	Lockheed Engineering and Management Services Company (contractor)
NSI	Northrop Services, Inc. (contractor)
ORD	the EPA Office of Research and Development
OTS	the EPA Office of Toxic Substances
Region 4	EPA Region 4, Environmental Services Division
TDHE	Tennessee Department of Health and Environment
TVA	the Tennessee Valley Authority

- PRINCIPAL INVESTIGATORS
  Persons who may be EPA employees funded by EPA programs, who may be any scientist or contractor engaged by any Federal,

state, city, or international organization, and who are approved by the EMTS Steering Committee to conduct exposure assessment related studies at the EMTS.

- PROGRAM MANAGER
  An EPA employee who represents the interests of the Office of Research and Development and is chairman of the Steering Committee.

- PROJECT COORDINATOR
  An EPA employee who has overall responsibility to EPA for the EMTS Project.

- PROJECT OFFICERS
  EPA employees who have management responsibilities for certain portions or tasks of the EMTS Project.

- PROVIDER
  The Office of Research and Development (ORD). Two ORD laboratories are involved, the Environmental Monitoring Systems Laboratory at Research Triangle Park, NC (EMSL-RTP), and the Environmental Monitoring Systems Laboratory at Las Vegas, NV (EMSL-LV). Both these laboratories report to the ORD Office of Acid Deposition, Environmental Monitoring, and Quality Assurance (OADEMQA).

- STUDIES
  The separate projects conducted by the Principal Investigators and approved by the Steering Committee. They will be called Studies rather than projects to distinguish them from "Project" which already means the EMTS Project. Studies must be supported by funds separate from those already allocated to the EMTS Project. Principle investigators must provide funds required for data management, data analysis, and field operations.

- USER
  A principal investigator.

SECTION III

MANAGEMENT AND FUNDING

COMMUNICATIONS STRATEGY

The ORD Program Manager has drafted an initial Communication Strategy for the Environmental Methods Testing Site. A copy is included as Appendix A. The communication strategy lists the contacts for the major participants and for other offices within EPA who must be kept informed of project status. It is designed primarily to provide a smooth conduit of information about the project to government officials, affected parties, and the public.

In keeping with EPA policy, a new communication strategy must be written for each major event within a project. Therefore, a separate communication strategy will be developed and documented for each study conducted at the EMTS.

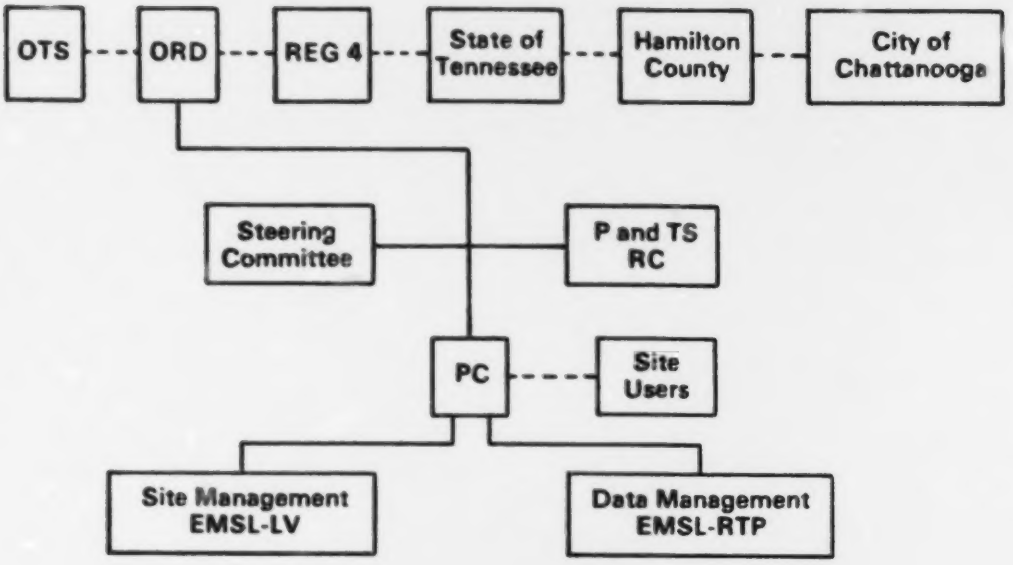
SUPPORTING DOCUMENTS FOR THE EMTS

Resolutions agreeing to the Project were passed by Hamilton County and the City of Chattanooga. A copy of these documents is included in Appendix B.

ORGANIZATION

Figure 1 gives an overview of the EMTS management structure and the relationship of the participants in the EMTS Project. The Pesticides and Toxic Substances Research Committee is an EPA research committee which sets funding priorities for projects related to the Office of Pesticides and Toxic Substances, the client for this project. The Office of Research and Development is responsible for implementing the EMTS Project. The EMTS Steering Committee membership consists primarily of delegates from the project participants and was formed especially for this project. The membership and functions of the Steering Committee are discussed below. The EMTS Project Coordinator carries out the decisions of the Steering Committee through the two ORD laboratories, EMSL-RTP and EMSL-LV, and acts as the contact for users of the site.

EMTS Project Management



LEGEND:

OTS — Office of Toxic Substances
ORD — Office of Research and Development
P and TS RC — Pesticides and Toxic Substances Research Committee
PC — Project Coordinator
EMSL-LV — Environmental Monitoring Systems Lab at Las Vegas
EMSL-RTP — Environmental Monitoring Systems Lab at Research Triangle Park

Figure 1. EMTS management structure

An overview of EPA line management for the EMTS Project is shown in Figure 2. EPA employees assigned to the various positions are also given:

ORGANIZATION	POSITION	REPRESENTATIVE
OTS	Client Office Representative	Joseph Breen
ORD	Program Manager	Mike Dellarco
EMSL-RTP	Project Coordinator	Bob Jungers
EMSL-RTP	Technical Monitor to NSI	Tom Lawless
EMSL-LV	Project Officer to ERC	Shelly Williamson
EMSL-LV	Technical Monitor to LEMSCO	Tim Foresman

STEERING COMMITTEE

The EMTS Steering Committee was formed to provide direct communication among EPA and the state and local officials and local citizens' groups. The functions of the committee are listed below. The committee members having the lead responsibility for each function are noted in parentheses:

1. Work closely with the Pesticides and Toxic Substances Research Committee to report EMTS progress to EPA management in order to assure a continued base funding level for the duration of the EMTS Project. (ORD Project Manager)

2. Stay current on the research needs of EPA which can be met by studies at the EMTS. (ORD Project Manager)

3. Advertise the capabilities and advantages of the EMTS and solicit participation by principal investigators to perform studies at the EMTS by publishing a "fact sheet" or brochure on the EMTS Project. (ORD Project Manager)

4. Provide for the timely review of proposals for scientific studies to be conducted at the EMTS. (Appointed subcommittee that would select reviewers appropriate to each study.)

5. Set priorities among scientific study proposals according to the resources available to the EMTS and the needs of EPA. (ORD Project Manager)

6. Adopt a set of requirements and standards for study plans, including the format, time schedules, and the procedures necessary for gaining approvals. (Whole committee, based on suggested guidance given in a following section.)

7. Provide timely decisions on approval or rejection of study plans. (Project Coordinator, based on recommendations of the appointed subcommittee.)

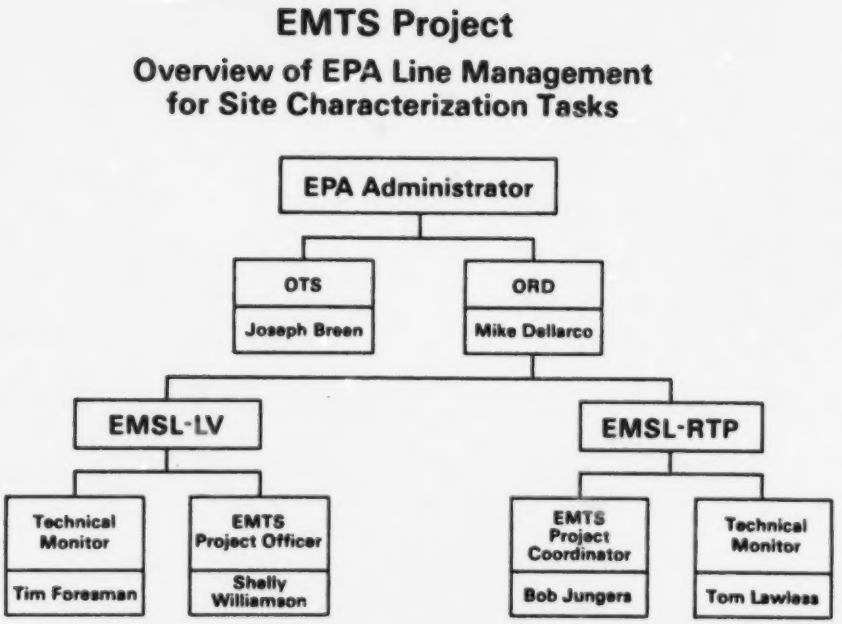


Figure 2. Overview of EPA line management.

8. Provide for the timely peer review of reports resulting from studies conducted at the EMTS. (The Project Coordinator in cooperation with the Principal Investigator of the study would select reviewers appropriate to the study.)

9. Agree on a periodic meeting schedule, and maintain an alternative means of communication such as a conference call when personal meetings are not conducted.

10. Provide that all member organizations maintain at least one representative at all times for meetings and other Steering Committee business, and designate alternate representatives when necessary.

11. Distribute minutes of Steering Committee meetings to all members and advisory committee members within ten days of each meeting or conference call.

The structure and membership of the EMTS Steering Committee is shown in Figure 3.

Persons acting as the five voting delegates and their alternates to the Steering Committee are as follows:

Chairman and ORD Program Manager	Michael Dellarco
Alternate	Gerald Akland
State of Tennessee represenative	Michael Bruner
Alternate	Harold Hodges
Hamilton County representative	Howard Roddy
Alternate	Steve Meyer
City of Chattanooga representative	J. Wayne Cropp
Alternate	Gaines Hobbs
EPA Region 4 representative	James Finger
Alternate	Winston Smith

Standing nonvoting members and their alternates are listed below:

Project Coordinator	Robert Jungers
Alternate	Shelly Williamson
EPA Office of Toxic Substances	Joseph Breen
Alternate	Philip Robinson

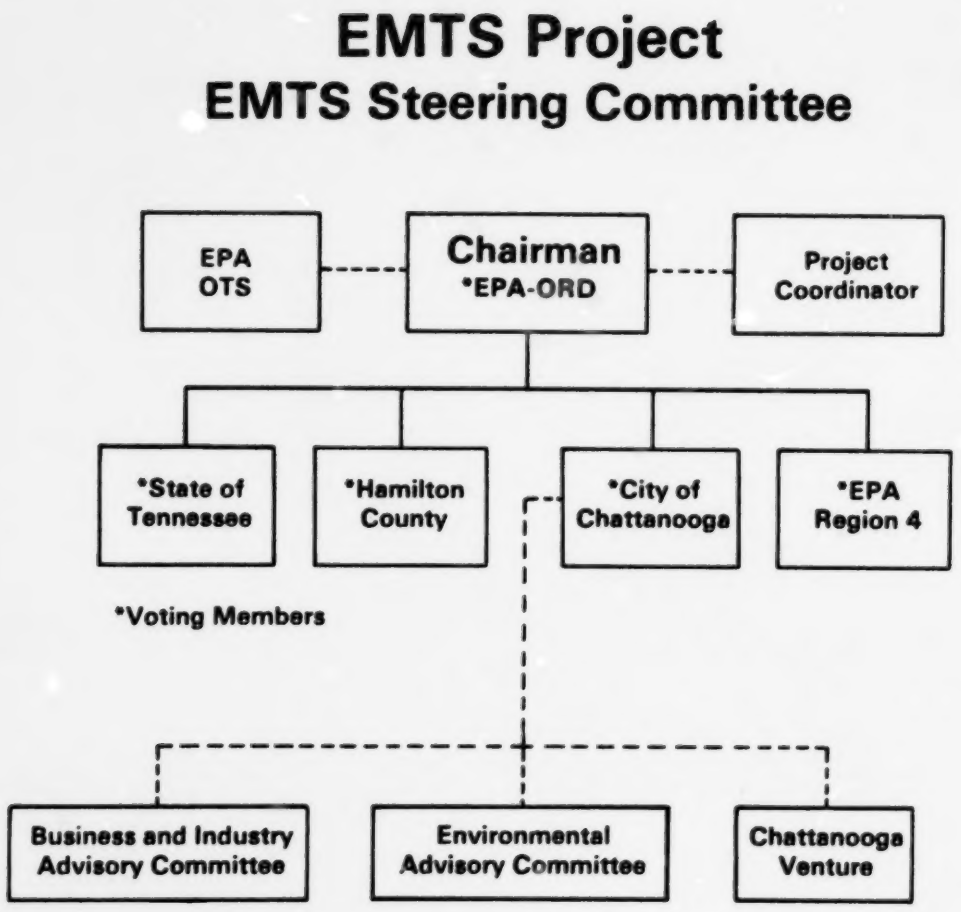


Figure 3. EMTS steering committee.

The first meeting of the EMTS Steering Committee was held in Chattanooga on July 18, 1985. It was decided in the meeting that the Steering Committee would consist of five voting members, two from EPA and one each from the state, county, and city. In addition there would be two local advisory committees of five members each. One is the Business and Industry Advisory Committee made up of five members of the Chattanooga Chamber of Commerce and the Chattanooga Manufactures Association. The chairman or one representative of this group will attend the EMTS Steering Committee meetings. The other is the Environmental Advisory Committee having five members, one each from the Sierra Club, the League of Women Voters, the Clean Air Association, the Chattanooga Audubon Society, Inc., and the American Lung Association. Subsequently the Guardians of Chickamauga Creek were added to this group.

The chairman or one representative from this group will attend EMTS Steering Committee meetings.

Wayne Cropp will provide liaison to Chattanooga Venture, a volunteer city planning group with environmental interests. Mr. Cropp will represent this group and the two Advisory Committees through his vote as representative for the City of Chattanooga.

The contact for the state of Georgia is Harold Reheis, Assistant Director, Environmental Protection Division, Georgia Department of Natural Resources. The state of Georgia will be represented on the Steering Committee by proxy through James Finger, EPA Region 4.

The Steering Committee provides a mechanism for formal and direct communication among the major participants in the EMTS Project. While traditional lines of management will be retained for funding, delegation of authorities, contracting, and reporting procedures, the network formed by the Steering Committee will streamline operations of the EMTS Project. The Steering Committee also provides a mechanism for direct communications with members of the local community primarily through the two advisory committees and the public relations staff of the Air Pollution Control Bureau.

The names and affiliations of members of the advisory committees are listed below:

Environmental Advisory Committee (June 1986)

Ms. Barbara Kelly	Chattanooga Clean Air Coalition
Ms. Janet Phillips (Chair)	Chattanooga Audubon Society, Inc.
Mr. Robert Pyle	Sierra Club
Ms. Geri Spring	Guardians of North Chickamauga Creek

Ms. Jean Stansell	American Lung Association
Ms. Caroline Williams	League of Women Voters

Business and Industry Advisory Committee (June 1986)

Mr. Oliver Benton (Chair)	Director, Center for Productivity Innovation and Technology, Chattanooga State Technical Community College
Mr. Ronald Cox	Dean, School of Engineering University of Tennessee at Chattanooga
Mr. John Eager	Director, Engineering Services Standard Coosa Thatcher
Mr. Larry Wingo	Environmental Engineer Combustion Engineering, Inc.
Mr. John Wittman	Vice President, Wheland Division North American Royalties

CONTRACTS AND AGREEMENTS

Figure 4 shows the contractual relationships among the EMTS participants. The rectangles represent the organizations and the curved-sided boxes represent documents which are either a contract, a cooperative agreement, or an interagency agreement. The arrows represent the direction of management and the direction of funding. Figure 4 can be considered to be a continuation of Figure 2, whereas EPA line management ends at the Environmental Monitoring Systems Laboratories, and contractual management begins. Notice that the State of Tennessee Department of Health and Environment and the Chattanooga-Hamilton County Air Pollution Control Bureau function both as Steering Committee members (and thus part of upper EMTS management) and as subcontractors to the ERC in data gathering activities. Horizontal dashed lines indicate informal working relationships.

The ERC is working under two different agreements which are meant to assist in the management of the EMTS site characterization tasks: a cooperative agreement with EMSL-LV and a subcontract with Combustion Engineering, Inc. (a contractor to EMSL-RTP).

Lockheed and Northrop are general support contractors to the Las Vegas and Research Triangle Park EPA laboratories,

EMTS Project

Contractual Relationships (12/85)

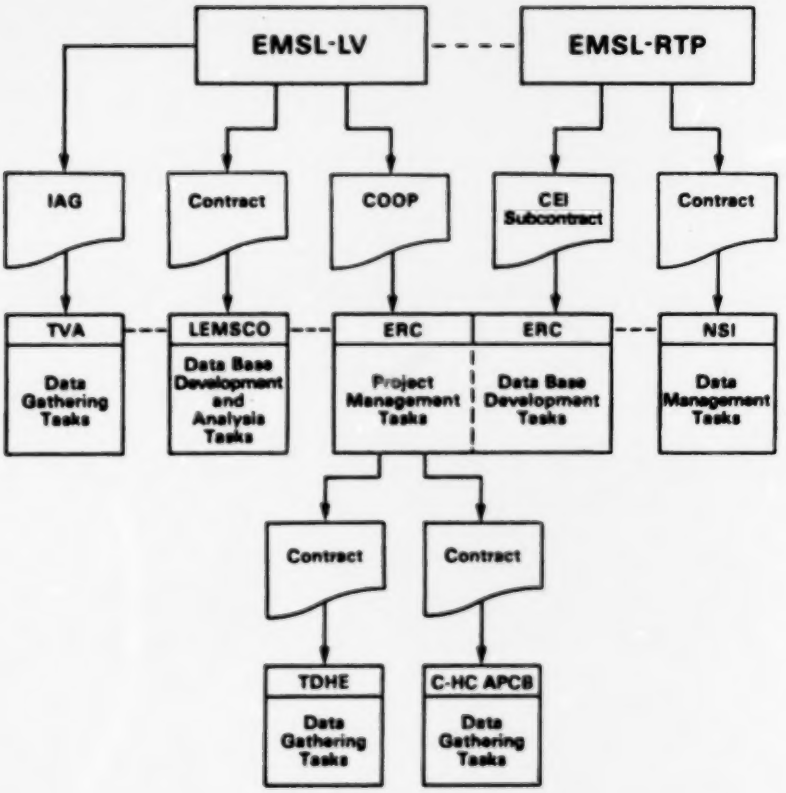


Figure 4. Contractual relationships.

respectively. They share the tasks related to data base development and data gathering. LEMSCO will operate the GIS in Las Vegas and will be responsible for data analysis. NSI will support data analysis efforts by providing data storage and external data processing of data base files used by the ARC/INFO GIS.

An interagency agreement between EPA and TVA allows TVA to provide data to the EMTS data base. Much of the needed digital map data can be obtained through TVA.

SECTION IV

MILESTONES

To accomplish the objective of the EMTS Project, a number of tasks must be completed in a certain order. Completion of tasks can be recognized by the passing of milestones which describe the outcome or product of the respective tasks. This section lists, in the order by target dates, the milestones and, if applicable, their completion dates for the period March 1985 through February 1987.

Complete	Target	Milestone
3-85	3-85	Cooperative Agreement, EMSL-LV and ERC
6-13-85	6-85	Identify site. See Appendix D.
7-85	6-85	Task Directive, EMSL-LV to LEMSCO
10-85	7-85	Task Directive, EMSL-RTP to NSI
7-85	7-85	Formalize Steering Committee
10-85	8-85	Contract, ERC and C-HCAPCB
12-85	8-85	Contract, ERC and TDHE
8-85	8-85	Define data requirements
8-85	9-85	Interagency Agreement, EMSL-LV and TVA-Chattanooga (expired 12-31-85)
12-2-85	12-85	Revise project management plan (draft)
3-31-86	2-86	Submit final project management plan for review
6-16-86	3-86	Write quality assurance program plan (revised draft)
3-31-86	3-86	Automate inventory file

3-3-86	4-86	Procure project tracking software
5-2-86	4-86	Implement geographic information system (training completed)
3-24-86	3-86	Fly aerial photo mission
	7-86	Write data management procedures plan (draft)
	9-86	Write EMTS brochure
	10-86	Complete data inventory
	10-86	Acquire base map data
	10-86	Demonstrate GIS
	11-86	OMB clearance package
	2-87	Annual report
	2-87	Write user's guide
	10-87	Review and update project management plan

SECTION V

DATA MANAGEMENT AND ANALYSIS

Data that are collected for the EMTS site characterization and data that are collected for specific studies generally can be classed into two groupings: spatial and tabular data. These two groupings are not mutually exclusive, but rather spatial data often have a tabular component, and tabular data, with very few exceptions, have a spatial component. Data that are primarily spatial in nature have a scalar value associated with a geographic location. The representation of this type of data lends itself toward mapping systems such as ARC/INFO. Data that have a series of scalar values all from the same geographic location do not lend themselves as well to map representations as they do to statistical analysis techniques. Data of the latter type require special storage techniques and statistical packages for the identification of outliers and analysis.

Some data are almost exclusively spatial. For example, aerial photographs and their digital representation capture a spatial relationship at a single point in time. Multiple maps are often used to show changes in the scalar values. Some data are almost exclusively tabular, for example, the results of a laboratory analysis. Multiple locations are most often represented as separate groupings of data, with one group per site.

Most of the data gathered for the EMTS site characterization and the data collected during EMTS studies will have elements of both types. Samples collected will have the location of the sample collection almost always associated with them. Conversely, data of a spatial nature almost always have a scalar or tabular value assigned to them.

The ARC/INFO system at EMSL-Las Vegas is better able to manipulate and represent spatial data, whereas the ADABAS system at NCC-Research Triangle Park is better able to handle tabular data. Together these two resources are able to provide a complete mechanism for the storage, analysis, and reporting of data from the EMTS.

All data that are predominantly spatial in nature will be collected and maintained by EMTS-LV. All data that are

predominantly tabular in nature will be collected and maintained by EMSL-RTP. In those cases where the most effective repository cannot be predetermined, the EMTS Project Coordinator will make the decision as to where the data are most likely to be needed. It may be necessary in some cases to have a data set in both locations; however, in this case, one site must be selected as the holder of the master and the other selected as holder of the copy. In this manner, the holder of the master can insure that the copy is updated as appropriate.

Technical details for data management will be documented in an EMTS Data Management Procedures Plan. The audience for this document will be the working level staff of EMTS participants and EMTS users.

TABULAR DATA

Tabular data, also termed statistical data, are most often presented as tables (flat files) having a number of headings of fields across the top and a number of records which form columns of values of the headings. The values in the various fields of a given record are usually related to each other. Two examples are names associated with addresses, or sampling station identification numbers associated with concentrations of several parameters measured at those locations.

The ability of the NCC ADABAS system to collect, store, and efficiently disseminate large quantities of data makes the NCC the logical repository of tabular data for the EMTS. Data sets can be merged, sorted, or selected very efficiently and quickly. ADABAS employs a relational data base management system. With a relational data base manager, data collected from diverse sources can be joined together easily for analysis or other processing. The storage of master tabular files will be the responsibility of NSI in Research Triangle Park.

Data that are stored in the EMSL-RTP ADABAS system will have quality assurance data associated with them. Therefore, only validated data will be available from this system. Data that have not yet been validated may be processed by EMSL-RTP on the NCC computer but will not be added to the ADABAS EMTS data base until validation is completed. Validation of data requires a judgement by knowledgeable persons familiar with the measurement techniques and the applications for which the data are to be used as to the suitability of the data in question for the use intended. Validation is the final stage of a quality assurance program.

All data stored on the NCC computers is in the realm of public access. The Freedom of Information Act allows access to

these data. Any data that are sensitive to the provisions of FOI should not be processed at NCC.

Data requiring statistical analysis will usually best be analyzed by the packages currently available on the NCC IBM. As with spatial data, the selected data sets can be the results of merging and collating data from a variety of source data bases. The following statistical analysis programs are available at the NCC:

SAS	Statistical Analysis System
SPSS-X	Statistical Package for the Social Sciences
ESP	Econometric Software Package
IMSL	International Mathematical and Statistical Library
BMDP	Biomedical Computer Programs

A short description of the capabilities of each of these packages is given in Appendix E, Part 1.

SPATIAL DATA

Spatial data constitute the cartographic component of the data base. Digital representations of diagrams, networks, polygons, lines, and points are stored in raster or vector formats. The display of such data is usually graphic in nature with maps. The storage of master spatial data files will be the responsibility of LEMSCO in Las Vegas.

Data that are stored in the EMSL-LV ARC/INFO system will have QC data associated with them. Only data that have been validated will be allowed to become part of the EMTS data base.

GEOGRAPHIC INFORMATION SYSTEM

Geographic Information Systems (GIS) provide the spatial analysis tools necessary to model the complex interactions between the physiography of a site, pollutant sources, and population distribution. Maps are digitized, registered to an earth coordinate system, and stored on a digital computer. The computer supporting the ARC/INFO GIS in Las Vegas is a DEC VAX 11/785. Point data are used to generate digital maps of the trend surfaces they represent. Digital population data and digital remote sensing data are entered to provide basic population and land cover information for the system. The

tools of digital overlay, trend surface analysis, pattern recognition, and Boolean logic are then used to model the complex interactions between the data "layers," and provide an environmental monitoring systems approach to exposure assessment. Data and analyses are placed in their original spatial context, and the resulting products are usually placed in a digital map form.

The main purpose for assembling an EMTS data base is to characterize the six-county Chattanooga study area. At least two uses of the data base are envisioned. First, with the aide of the GIS, the existing data can be analyzed, and certain conclusions about the relationships between sources and receptors of pollution may be possible. Second, and perhaps more importantly, researchers can use the GIS and the existing data to help plan studies needed to reveal relationships inherent in human exposure mechanisms. GIS analysis can point out areas that should be looked at more closely or areas that have insufficient data to draw valid conclusions.

The GIS will use the ARC/INFO software which is a product of ESRI (Environmental Systems Research Institute) and which will be located at the EMSL in Las Vegas. Lockheed Engineering and Management Services Company will be the custodian of the system which will be installed on a DEC VAX 11/785 computer. More information about the GIS is given in Appendix E, Part 2.

DATA BASE DEVELOPMENT

The guiding strategy for assembling the EMTS data base is to first inventory existing, available data, then to review the collection of these data, and by using predetermined priorities and criteria, to select those data sets thought to be suitable for intended uses. Success in assembling the EMTS data base will depend upon a reliable means of data transmission and upon a set of priorities for selecting the data.

Data Transmission

From now through the duration of the project, there will be a need for transmitting data from various sources to central locations for processing. During the site characterization phase, the need for data transmission capability may be greatest. It is during this phase that the initial EMTS data base will be assembled from many diverse sources.

Although the primary data analysis tool for the EMTS Project, the ARC/INFO geographical information system, will be located in Las Vegas, the bulk of the statistical environmental data gathered for the system will be stored at the National Computer Center at Research Triangle Park. Thus the greatest

use of any type of data transmission capability will be in moving data from RTP to Las Vegas. The second most likely used route of data transmission will be from the other participants, who are sources of data, to RTP. A third route, but perhaps of less frequent need, will be directly from these participants to Las Vegas. The need will depend on the type of data and its volume.

The various available modes of data transmission for the EMTS Project are discussed more thoroughly in Appendix E, Part 1.

Data Priorities

Initially, the data base will consist of selected, currently available data. The task is to select some of these data sets, document their quality, and put them into a form usable by ARC/INFO. Environmental Systems Research Institute (ESRI), the vendors of ARC/INFO, will assist in designing the ARC/INFO files.

Typically, a GIS data base is determined by the specific goal or analyses intended. In the case of the EMTS Project, the goals are broad, attempting to satisfy the needs of many possible studies simultaneously. It can be assumed that certain types of data will be needed for most studies. A basis for defining the source data needs is presented below:

Divide the data into two major categories:

I. Geographic data
II. Environmental quality data

Subdivide the two major categories into themes. The themes describe the general categories of data needs:

I. Geographic data

1. Natural resources
2. Hydrography
3. Meteorology
4. Political and administrative units
5. Demography
6. Infrastructure and cultural features
7. Health related data
8. Agricultural and commercial data
9. Special biological resources
10. Special physical features

II. Environmental quality data

1. Air
2. Water
3. Soil
4. Food

The themes are further subdivided into attributes. An example of the attribute data elements for the theme, natural resources, is shown below:

1. Types of natural resource data

soils
geology
slope
vegetation
land use
other

A further example is given for the theme, air:

11. Types of air quality data (parameters measured and purpose)

NAAQS criteria pollutants
(O_3, CO, NO_X, SO_X, TNMH, TSP, Pb)
VOC's
Bioaerosols
Associated meteorology
Emissions data
Indoor air
Ambient
Point source

A detailed listing of all attributes and themes is given in Appendix F, Inventory File Field Descriptions. The list of data types developed for the inventory file and any amendments to this list will be the basis for EMTS data base development. These categories of data will be considered in the Data Management Procedures Plan and the QA Plan. The use of information entered into the inventory file will help planners set priorities for selecting data sets to be processed into the GIS. Further discussion of the inventory and tracking system is given in the following section.

Although the EMTS is the entire six-county SMSA, priority generally will be given to the Chattanooga urbanized area which contains the greatest concentration of people. The urbanized area is rather ill-defined and changes year by year, but as of 1983, according to the Bureau of the Census Index to Block

Numbered 1980 Census Maps, it extended into 17 of the 54 quadrangles which constitute the Chattanooga SMSA.

Because the urbanized area is so large, a smaller area has been chosen in which to test the GIS. A pilot GIS data base will be assembled for the incorporated area of the City of Chattanooga. Figure 5 shows a map of the 54 quadrangles that make up the Chattanooga SMSA. The incorporated area is the shaded area near the center of the figure.

In summary, data sets will be selected for examination and possible eventual incorporation into the EMTS data base by a series of decisions. The first to be selected will be those of broadest application which are easiest to obtain. Preliminary GIS analyses and further study design will dictate the needs for greater specificity.

QUALITY CONTROL AND TRACKING SYSTEM

To characterize the EMTS, all available and usable data concerning the physical, environmental, and demographic characteristics of the Chattanooga area must be first inventoried, then collected and reviewed, and finally put into a common data base where they can be analyzed. Data base development for use in the ARC/INFO geographic information system is a three-tiered process. (See Figure 6.)

The first level is to create an inventory of available data sets. This information will be assembled by ERC in an Inventory File using dBASEIII. The file structure and field descriptions for the Inventory File are given in Appendix F.

The participating agencies and contractors involved in the task of finding information relevant to Chattanooga are listed in Table 1. Not all of the agencies and offices participating in the EMTS Project are gathering data. The responsibilities of all the participants are discussed in Section III. Each participant actively gathering data is assigned a one-character code for use in the Inventory File.

The data sets inventoried by the noted participants are of various types and are stored on various media. The data are stored in several different computers, on tapes, on disks, and on paper. The Inventory File format will be distributed to all data gathering participants. Whenever a data set is discovered by a participant, that participant will log the appropriate information describing that data set into the Inventory File by using his IBM PC or compatible machine. Participants will mail a copy diskette of their Inventory File to ERC every three months or more frequently if required. ERC, in turn, will

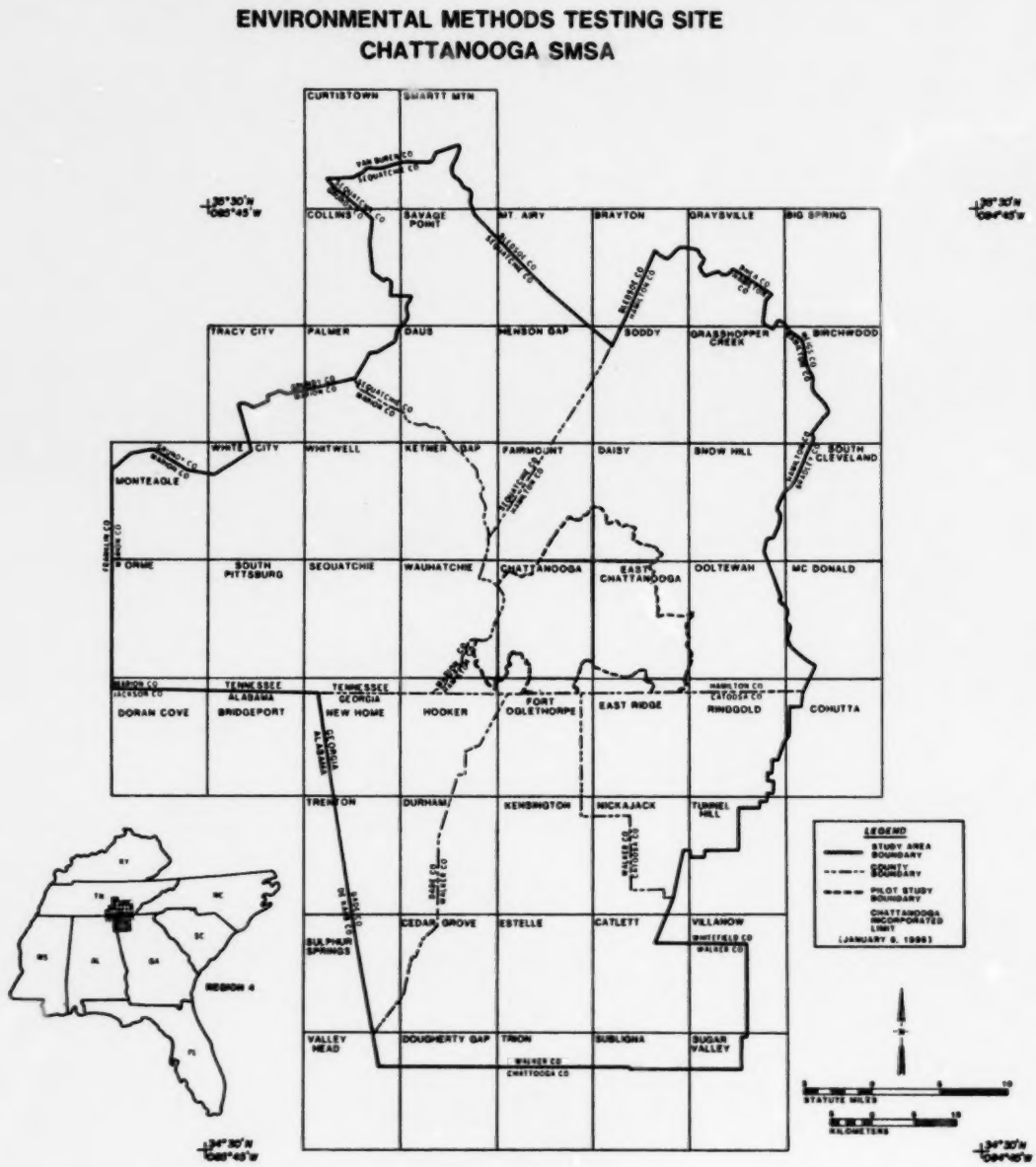


Figure 5. Map of the EMTS project study area.

collate the various versions of the Inventory File, will combine unique entries, and will return a copy of the complete master file to all participants.

TABLE 1. PARTICIPANTS GATHERING DATA

0	Not listed. (New participants will write in their names)
1	Chattanooga-Hamilton County Air Pollution Control Bureau
2	Environmental Monitoring Systems Laboratory-Las Vegas
3	Environmental Monitoring Systems Laboratory-Research Triangle Park
4	Environmental Research Center (Las Vegas)
5	EPA Office of Toxic Substances (Washington D.C.)
6	Lockheed Engineering and Management Services Co. (Las Vegas)
7	Northrop Services, Inc. (Research Triangle Park)
8	Tennessee Department of Health and Environment (Nashville)
9	Tennessee Valley Authority (Chattanooga)

The entire collection of data sets listed in the Inventory File will be called the EMTS Working Data Base. This is the first level of data base development. Nothing will have been done to the data sets at this level other than to find them and to log a description of them into the Inventory File. Each participant will assign a reference number to each document, report, or data set identified during the inventory process.

Figure 6 shows the three levels of data base development and the parallel development of a tracking system. A great deal of work will be necessary to move data sets from the first level to the second. The collection of data sets which make it to the second level will be called the EMTS Data Library. ERC, with the help of the respective participant, will review all (or a sample) of a data set, note its comments concerning data quality into the EMTS Reference File, the second level of the tracking system. The data set itself may be moved or reformatted at this second level. Data flow schemes and quality assurance procedures for the EMTS data base are presented in the EMTS Quality Assurance Plan.

The Data Library (the second level of data base development) will be the collection of data sets having passed a number of quality assurance tests which will have been well documented in the dBASEIII Reference File by ERC. A detailed description of the quality assurance procedures and tests is given in the EMTS Quality Assurance Program Plan. The Data

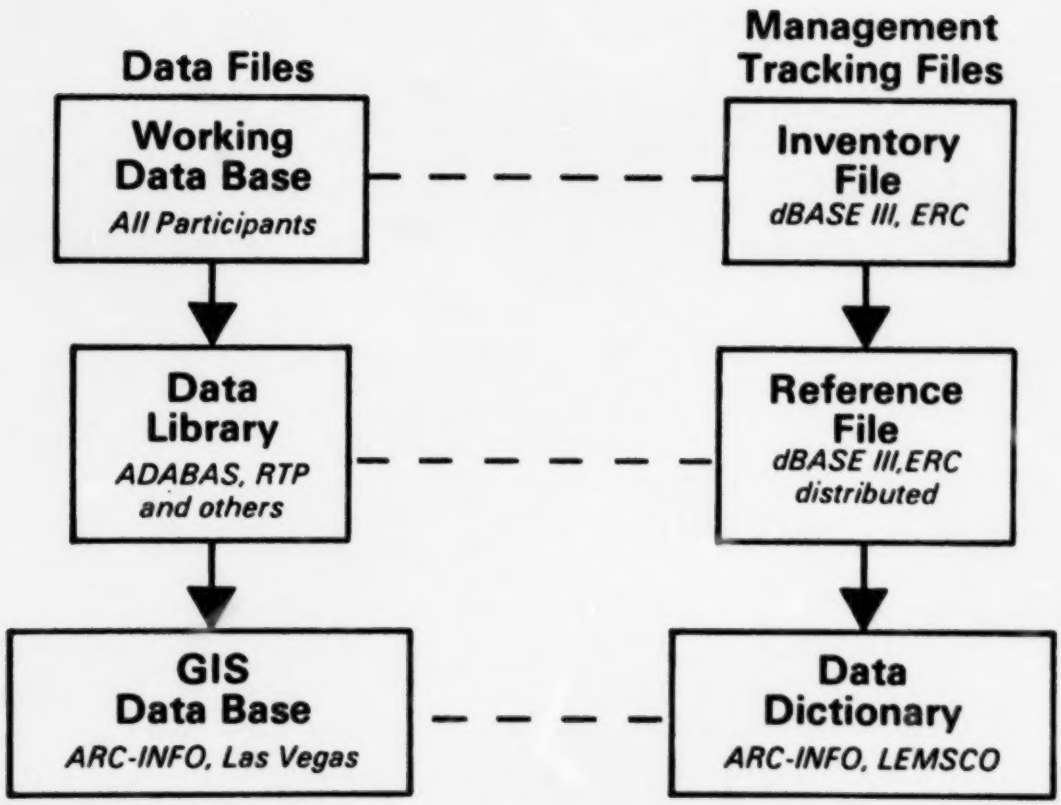


Figure 6. Data base development.

Library will be ADABAS files or other data base management system files, tape files, and disk files ready to be accessed by the VAX 11/785 in Las Vegas for use by ARC/INFO. At this mid level, the files will not be ARC/INFO files. The files will be "clean," however, so that further processing can be done either by ARC/INFO or by some external data system such as ADABAS for loading into the VAX.

When data selected for GIS analysis are loaded into ARC/INFO and become ARC or INFO files, they become part of the EMTS GIS DataBase, the third and final level of data base development. These files are, for the most part, derivatives of data sets in level two. They have a special file structure and are related to map features in the GIS. The counterpart to the GIS Data Base in the tracking system at the third level is the EMTS Data Dictionary.

The Data Dictionary will reside in INFO files on the VAX as part of the local system. There will be a one-to-one mapping of entries in the Data Dictionary to files in the GIS Data Base. Entries to the Data Dictionary will be derived from information in the EMTS Reference File plus new information as required to describe the unique nature of the ARC/INFO files. The derivation of files in the GIS Data Base will be documented in the Data Dictionary by reference to entries in the Reference File. Hence, a complete document trail will be available to EMTS users for the EMTS data base.

STUDIES AND EMTS USERS

Access to the EMTS data base will be through the Reference File which will contain the most comprehensive listing of data sets and ancillary information. The first-level Inventory File may have more entries for data sets but will have little QA information. The third-level Data Dictionary will be very thorough, but only for the data sets residing in the GIS. Entries in the Reference File, however, will include everything that is known about the data sets, and it will be cross-referenced to the Data Dictionary to indicate which data sets have been used to derive a GIS Data Base file for ARC/INFO. Users can get a good idea what is available by querying the Reference File. When an actual data analysis is being planned, interaction with the LEMSCO GIS operators will be necessary. The operators will help users to design specific GIS programs to derive special map files and customized data analyses. Remote and multi-user access to the GIS is not available at this time (1986), but a policy on this issue is forthcoming from EPA. For the time being, only LEMSCO operators will have hands-on access to the VAX.

EMTS Support of Studies

The main objective of the EMTS is to provide a well-characterized site for studies that will test methodology for assessing human exposure to toxic substances. All of the time and money spent on site characterization, data base development, analytical system development, and political and monetary agreements is for the support of such studies. The number of concurrent studies will be limited only by funding or by consensus of the Steering Committee acting in the best interests of the community.

Studies can be conducted by any agency and must be funded separately from the EPA base funding which is allocated to the EMTS Project itself. Data generated by any approved study conducted at the EMTS will be added to the EMTS data base after a review for data quality by the principal investigator and ERC. In this manner, the EMTS will become better and better characterized and thus more useful for future studies.

Principal investigators, the EMTS users, may use contractors to conduct their studies. By using the EMTS, certain functions of a study can be aided by the in-place functions of the EMTS. Contributions to studies by the EMTS Project include data management, guidance on quality assurance procedures, data analysis by the ARC/INFO geographical information system, and public relations on site. Included in data analysis is the use of the EMTS data base established to characterize the site. Most needed background information already will be available in this data base and will save much time and expense to users. It must be noted, however, that the EMTS Project does not have the resources to provide all of the data management and analysis a study may require; thus, study budgets must include funding for these services.

Protocols for proposed studies must be prepared in an approved format and must be submitted to the Steering Committee through the Project Coordinator for approval. When approval to proceed is given, the Project Coordinator will provide principal investigators with all the information necessary to use established EMTS facilities. When a study is accepted, the principal investigator becomes responsible for keeping the Steering Committee informed for the duration of his study.

Guidance for Study Plans

To insure that study plans are accepted for review by the EMTS Steering Committee, the following points must be included. These points are discussed more fully in Appendix G.

Guidance for Study Protocols

*Background
*Objective
*Rationale
*Methods and procedures
*Quality assurance
*Results
*Evaluation and interpretation of data
*Management and funding
*Schedule with identified products
*Communication strategy

User's Guide

The EMTS User's Guide will explain how to gain access to the EMTS system and will describe the status of the EMTS data base. Further guidance on preparing the study proposals and the procedures for submitting them to the EMTS Steering Committee will be included. It will be illustrated with graphics generated by ARC/INFO using data relevant to Chattanooga. Distribution of the user's guide will be the prerogative of EPA, but, in general, it is intended that it reach other organizations and persons who could conduct studies to advance the science of human exposure assessment and who might find the environment of the EMTS beneficial to their plans.

Users of the EMTS system can be of two types: those who wish only to analyze the existing data (in the EMTS data library), and those who expect to conduct field studies at the EMTS. The latter group would first use the GIS and EMTS data library to help design a field study and then use the system again to analyze the data they had collected during the study. It is expected that the data collected in this manner would be donated to the EMTS data base and would have to meet the data quality standards set for the EMTS Project.

Access to the EMTS data base and GIS will be arranged whenever a study plan is approved by the EMTS Steering Committee. Principal investigators must contact the Project Coordinator to set up a working relationship with the LEMSCO GIS operators. The principal investigator (EMTS user) then will work with ERC and LEMSCO to jointly design a GIS analysis based on the intent of the study and on the available data in the data library. Users will be expected to list the types of data they need to support a given analysis. The Project Coordinator will make arrangements with EMSL-RTP and the EPA National Computer Center (NCC) to enter, process, and store validated data generated by field studies. Users will be expected to validate their data and to release it to the EMTS

data base in a timely manner according to the study schedule approved by the Steering Committee.

SECTION VI

REPORTS

QUARTERLY REPORTS

EPA Project Officers and Technical Monitors, who are managing contractors and who are performing tasks for the EMTS Project, should include periodic reporting requirements in their respective task directives and should make these reports available to the Project Coordinator.

It is recommended that all participants prepare progress reports quarterly. Reports will be due at the end of each quarter that a participant is active in the EMTS Project. The Project Coordinator (PC) will prepare a quarterly compendium of reports which can then be distributed to all the other participants. Such a practice will help keep everyone informed and will ensure that activities and milestones are documented. Because the Federal fiscal year is October 1 through September 30, it is preferred by EPA that the quarterly reporting schedule to the appropriate Project Officers (PO) be as follows:

Quarterly Report	Period Covered	To PO	To PC
First	10-1 to 12-31	1-15	1-30
Second	1-1 to 3-31	4-15	4-30
Third	4-1 to 6-31	7-15	7-30
Fourth	7-1 to 9-30	10-15	10-30

Project Officers receiving quarterly reports from their respective contractors should forward copies to the Project Coordinator within 30 days after the end of the reporting period. The Project Coordinator will assemble an overall EMTS Project Quarterly Report and distribute it to all participants within 45 days after the end of the reporting period. Please send all quarterly reports to EMSL-RTP to the attention of:

Robert Jungers
EPA, EMSL-RTP (MD-56)
Research Triangle Park, NC 27711

The format for quarterly reports should be as follows:

TITLE - Quarterly Progress Report, EMTS Project
REPORTING AGENCY - (agency name and name of preparer)
REPORTING PERIOD - from (date) to (date)
I. PROGRESS TO DATE
II. PROBLEMS
III. PROJECTED WORK FOR NEXT QUARTER

STUDY REPORTS

Principal investigators conducting studies at the EMTS shall prepare monthly progress reports for the EMTS Project Coordinator. The Project Coordinator shall distribute copies of these reports to the Steering Committee as a means for the Committee to track the progress of studies against milestones set forth in approved study protocols. The Steering Committee shall keep its advisory committees apprised of all study results and activities and may ask principal investigators to prepare special reports during the course of a study.

ANNUAL REPORTS

In assisting the EMTS Project Coordinator, ERC will coordinate the annual reporting procedures for all the EMTS participants, collect the information, and prepare an annual report to the Project Coordinator, through the EMSL-LV Project Officer. The annual report will be a comprehensive description of all significant activities and milestones accomplished by participants in the EMTS Project. Unless other participants are requested by their Project Officers to prepare separate annual reports, ERC will prepare the EMTS annual report from the collection of quarterly reports and personal communication with the participants as needed.

Timely preparation and distribution of the quarterly reports will help insure that preparation of the annual report is on time and that all significant activities are included in it. The due date for the reviewed and edited annual report shall be February 1; the first draft shall be due December 1.

Please send all materials for the annual report to ERC no later than November 15 to the attention of:

Charles Fitzsimmons
EMTS Technical Manager
Environmental Research Center
University of Nevada-Las Vegas
4505 Maryland Parkway
Las Vegas, NV 89154

USER'S GUIDE

The EMTS User's Guide is a document needed to advertise the capabilities and advantages of the EMTS Project to prospective users of the site. The EMTS User's Guide is listed as an EMTS Project milestone in Section IV of this management plan and will be prepared jointly by LEMSCO and ERC. Scheduling of this project output depends on the completion of a major part of site characterization, i.e., assembling a useful data library and implementing operation of ARC/INFO (another milestone listed in Section IV). The EMTS User's Guide will be written for potential principal investigators who may wish to conduct studies at the EMTS (Chattanooga) and to make use of the analytical capabilities of the GIS.

EMTS MANAGEMENT PLAN

APPENDIX A

COMMUNICATIONS STRATEGY FOR THE EMTS

A communication strategy was prepared by the Office of Research and Development as part of the procedures to initiate the EMTS Project. The following document lists the contacts for the major participants and other EPA Offices who must be kept informed of project status.

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

AUG 15 1985

OFFICE OF
RESEARCH AND DEVELOPMENT

SUBJECT: Communication Strategy for the Environmental Methods Testing Site (EMTS)

FROM: Donald J. Ehreth
Deputy Assistant Administrator
for Research and Development (RD-672)

TO: Phil Angell
Office of the Administrator (A-101)

BACKGROUND

Early in 1983 the EPA's Office of Research and Development began a search for one urban location in the United States which could serve as a field site to test and evaluate new pollution monitoring systems, equipment and analytical methods. Chattanooga, Tennessee was one of the cities which qualified as a suitable site for this project on the basis of its population size, geographic location, and industrial diversity. After considerable discussion at the regional and State level, Hamilton County and the Chattanooga City Council Commission resolved that Chattanooga be designated the Environmental Methods Testing Site (EMTS). Selection of Chattanooga as the EMTS was announced by Region IV to the Tennessee press. This release was coordinated with Chattanooga. Documents currently available concerning the test site are the EMTS Fact Sheet, and the draft Management Plan.

The announcement date and content of any press material were jointly decided by the City, Region IV, and OEA Headquarters with the participation of ORD.

OTHER EPA OFFICES INVOLVED

OPTS	Office of Toxic Substances	Joe Breen (FTS 382-3569)
OEA	Office of Congressional Liaison	Dona DeLeon (FTS 382-5660)
	Office of Public Affairs	Elly Seng (FTS 382-4384)
Region IV	Environmental Services Division	Jim Finger (FTS 250-3136)
	Public Affairs	Frank Redmond (FTS 257-2013)

GROUPS WITH SPECIAL INTEREST IN THIS ACTION

Industrial Associations -- Chattanooga Manufacturers Association, Chattanooga Chamber of Commerce

Some of the employees in Chattanooga industrial plants may particpate in evaluating total human exposure assessment methodology techniques.

Environmental Associations -- Environmental groups include: Audubon Society, Sierra Club, American Lung Association, Clean Air Coalition and League of Women Voters.

This project may shift awareness of these groups to multi-pollutant/multi-pathway exposures associated with indoor microenvironments and consumer products.

Government

OMB -- OMB supports the EMTS concept. Wayne Leiss is the contact.

Congressional Delegations -- Staffers have been briefed for Senator Gore (Steve Owens) and Senator Sasser (Nanette Gandy). Congressman Lloyd's staffer (Howard Elliot) has received a preliminary fact sheet.

Region IV -- Region IV has played an instrumental liaison function in site selection and project implementation. Mr. Jack Ravan, Regional Administrator, has briefed CDC, TVA, and FDA about the nature of the EMTS project. The Regional Administrator has assigned Mr. Jim Finger, Director, Environmental Services Division to assist us with this project.

State of Tennessee -- The Department of Health Environment supports the EMTS concept. The Assistant Commissioner, Dr. Michael Bruner, assisted us in contacting Hamilton County and Chattanooga city officials about the EMTS project. Dr. Bruner is a member of the EMTS Steering Committee.

Hamilton County -- County Executive, Mr. Dalton Roberts supports the EMTS project and has assigned Mr. Howard Roddy, Administrator of the Health Services Division, to the EMTS Steering Committee.

City of Chattanooga -- Mayor Gene Roberts, and the City Council have agreed to our request to locate the EMTS at Chattanooga. He has assigned Mr. Wayne Cropp, Head of the Air Pollution Control Bureau to assist us. Mr. Cropp is a member of the EMTS Steering Committee.

EMTS Contacts

Project Direction: Michael Dellarco - ORD, Headquarters

EMTS Project Management: Robert Jungers - ORD, EMSL-RTP

Site Characterization and Technical Support: Shelly Williamson, ORD, EMSL-LV

Regional Coordinator: Mr. Jim Finger, Region IV

Tennessee Coordinator: Dr. Michael Bruner, Assistant Commissioner, Department of Health and the Environment

Hamilton County Coordinator: Mr. Howard Roddy, Administrator of the Health Services Division of Hamilton County

City of Chattanooga Coordinator: Mr. Wayne Cropp, Director, Air Pollution Control Bureau

EMTS MANAGEMENT PLAN

APPENDIX B

SUPPORTING DOCUMENTS FOR THE EMTS

The following documents are included in this appendix:

1. Resolution: Hamilton County
2. Resolution: City of Chattanooga

STATE OF TENNESSEE
Hamilton County

May 15, 1985
DATE (Month Day Year)

Hamilton County Board of Commissioners

RESOLUTION

No. 585-28

TITLE A RESOLUTION ENDORSING THE U.S. ENVIRONMENTAL PROTECTION AGENCY'S PROPOSAL DESIGNATING HAMILTON COUNTY AND THE SURROUNDING STANDARD METROPOLITAN STATISTICAL AREA (SMSA) AS AN ENVIRONMENTAL METHODS TESTING SITE.

WHEREAS, the U.S. Environmental Protection Agency (EPA) has selected Hamilton County and the surrounding SMSA as its preferential national site for conducting detailed, long-range environmental monitoring and research in order that exposure associated studies can be conducted more economically and expediently than in separate cities; and,

WHEREAS, the five to fifteen (15) year study shall result in more environmental information on Chattanooga than any other U.S. city, and as such could nationally project Chattanooga as a high-level research community; and,

WHEREAS, EPA has $600,000 in its current federal budget with which to initiate establishment of the Environmental Methods Testing Site, with no matching County funds required; and,

WHEREAS, The Tennessee Department of Health and Environment has reviewed EPA's proposal and recommended that said proposal be accepted;

NOW, THEREFORE, BE IT RESOLVED BY THIS COUNTY LEGISLATIVE BODY, IN SESSION ASSEMBLED:

That the U.S. Environmental Protection Agency's proposal, designating Hamilton County and the surrounding SMSA as an Environmental Methods Testing Site, is endorsed and that the Hamilton County Board of Commissioners is committed to the project's success.

BE IT FURTHER RESOLVED THAT THIS RESOLUTION TAKE EFFECT FROM AND AFTER ITS PASSAGE, THE PUBLIC WELFARE REQUIRING IT.

Approved: X
Rejected: ☐

CERTIFICATION OF ACTION

County Clerk

Approved: ☐
Vetoed: ☐

County Executive

Date

RESOLUTION NO. 16355

A RESOLUTION ENDORSING THE U.S. ENVIRONMENTAL PROTECTION AGENCY'S PROPOSAL DESIGNATING CHATTANOOGA AND THE SURROUNDING STANDARD METROPOLITAN STATISTICAL AREA (SMSA) AS AN ENVIRONMENTAL METHODS TESTING SITE.

WHEREAS, the U.S. Environmental Protection Agency (EPA) has selected Chattanooga and the surrounding SMSA as its preferential national site for conducting detailed, long-range environmental monitoring and research in order that exposure associated studies can be conducted more economically and expediently than in separate cities; and,

WHEREAS, the five to fifteen year study shall result in more environmental information on Chattanooga than any other U.S. city, and as such could nationally project Chattanooga as a high-level research community; and,

WHEREAS, EPA has $600,000 in its current federal budget with which to initiate establishment of the Environmental Methods Testing Site, with no matching City funds required; and,

WHEREAS, the Tennessee Department of Health and Environment has reviewed EPA's proposal and recommended that said proposal be accepted;

NOW, THEREFORE,

BE IT RESOLVED BY THE BOARD OF COMMISSIONERS OF THE CITY OF CHATTANOOGA, TENNESSEE, that the U.S. Environmental Protection Agency's proposal, designating Chattanooga and the surrounding SMSA as an Environmental Methods Testing Site, is endorsed and that the Board of Commissioners of the City of Chattanooga is committed to the project's success.

ADOPTED: 6/11/85

MAM:sca

APPENDIX C

EMTS FACT SHEET

Background

The Environmental Protection Agency (EPA) has a need to develop and improve methods for assessing human exposure to toxic substances to support regulations resulting from The Toxic Substances Act of 1976. Having the responsibility for administrating the Act, the EPA Office of Toxic Substances (OTS) has asked the EPA Office of Research and Development (ORD) for technical assistance. The Office of Acid Deposition, Environmental Monitoring, and Quality Assurance (ODEMQA) is that part of the Office of Research and Development which is responsible for monitoring methods development and validation and quality assurance support for the Environmental Protection Agency. Through the ODEMQA laboratories, ORD is providing the research needed by OTS.

Field tests of monitoring equipment, survey techniques, or models for assessing exposure require that large amounts of data be collected, usually at one or more selected sites. Much of the resources for such projects goes into the preliminary work, selecting and characterizing a study site, before the actual study can begin. The concept of the Environmental Monitoring Testing Site (EMTS) is to perform the preliminary work once and then to proceed with any number of projects at the same, well characterized site. This unique approach will provide a system of funding mechanisms, support agreements, and approvals. The EMTS will be a uniquely characterized city where a very large data base has been computerized into an interactive geographical spatially related system.

The only steps necessary to initiate field projects will be approval of the project plan and quality assurance plan by an appropriate review authority. The EMTS structure offers a considerable savings in costs and time to investigators contemplating field studies of exposure assessment methods.

Objective

The objective of the Environmental Methods Testing Site Project is to provide a well-characterized site in which to

develop, test, and compare multimedia exposure monitoring methodology. The emphasis is on characterizing one site in detail so that any number of exposure assessment studies can be conducted more economically and quickly than they could be conducted in separate cities.

Purpose

The selection of one location with a common data base affords a unique opportunity to test equipment and monitoring designs. Consequently, a number of projects may be conducted at the EMTS:

* Test designs of exposure surveys.
* Test field performance of environmental measurement methods.
* Evaluate techniques for data analysis and models.
* Evaluate quality assurance procedures development.

Once the EMTS is established and the data management system is in place, investigators from the EPA program offices, other Federal agencies, state and local departments, and international organizations will be invited to use the site. Proposals will be reviewed by a steering committee consisting of members from the EPA Office of Toxic Substances (OTS), the EPA Office of Research and Development (ORD), the EPA Region 4 Office, the State of Tennessee Department of Health and Environment, Hamilton County, and the City of Chattanooga. Details of the relationships among EMTS participants are given in the EMTS Management Plan. Interest in using the EMTS for an in-depth climatological study already has been indicated by the National Oceanic and Atmospheric Administration (NOAA).

The promise of efficient use of agency resources makes the EMTS a logical choice for the United States Human Exposure Assessment Location (HEAL), a World Health Organization project.

Status

After a lengthy site selection process (briefly described in the following section), candidates for the EMTS were narrowed to several cities in Region 4. On June 13, 1985, the City Council of Chattanooga, Tennessee, agreed to have the EMTS Project in their city. The major work effort in FY-86 will be to characterize the site.

Site Selection

EPA began the process for site selection in early 1983. Candidate sites were selected by using a set of criteria set

forth by a research committee of EPA representatives. Initially, 15 U.S. cities which met most of criteria established by the EPA for population, climate, isolation, industrialization, support facilities, and evidence of environmental pollution were selected. From this list, EPA compared the candidate cities in greater detail against the criteria. The final approval to establish the EMTS at Chattanooga was achieved by agreement with the Tennessee Department of Health and Environment, the Hamilton County Commission, and the Chattanooga City Commission. Further data gathering, especially in the areas of industrial mix, climate, and environmental pollution, resulted in the selection of Chattanooga. A more detailed account of the site selection process is given in Site Characteristics Document, June 28, 1985.

Site Characterization

To characterize the site, all pertinent data on the physical, environmental, and demographic characteristics of the Chattanooga Standard Metropolitan Statistical Area (SMSA) must be found, examined, and entered into a common data base.

Under a cooperative agreement with EMSL-LV, ERC has entered into contracts with the Tennessee Department of Health and Environment (TDHE) and the Chattanooga-Hamilton County Air Pollution Control Bureau (C-HC APCB). These two departments will perform data gathering functions at the State and local level. ERC will hire graduate students in Nashville and/or Chattanooga or from both areas to help collect and code existing data. The C-HC APCB also will provide public relations activities for the project in Chattanooga. EPA contractors, Lockheed Engineering and Management Services, Inc. (LEMSCO), in Las Vegas, and Northrop Services, Inc. (NSI), in Research Triangle Park, will begin building the digital data base. NSI will perform data management tasks, and LEMSCO will perform data analysis tasks by using a geographic information system (GIS). The ERC will coordinate all site characterization functions including the hiring and supervision of on-site employees, identification of data bases, and liaison with the State and City.

Data Analysis

The massive amounts of data which will be collected for the EMTS Project requires sophisticated computer analysis systems. LEMSCO will operate the ARC/INFO geographical information system in Las Vegas by using statistical environmental data files prepared at RTP in addition to map-like data files acquired elsewhere. The GIS uses data files which are referenced to geographical locations and, through the

interaction of such files, can derive new data files. These new files can be displayed graphically as maps for the ease of interpretation.

Data Management

Data management for the EMTS Project will proceed in three steps: a general inventory of available data, examination of the data for suitability for use in the EMTS data base, and development of the GIS data files. The EPA National Computer Center at RTP is well suited for the massive data storage and data base preparation functions that will be required by the EMTS. A coordinated effort by all interested parties is helping to identify needed data bases that already exist in national computer files. Much useful environmental data is not yet on computer media but is stored on paper in file cabinets. On-site employees will be used to find, sort, and code pertinent data for the EMTS data base.

Project Management

Communication among the several entities involved in the EMTS Project is facilitated by the formation of a steering committee. Persons acting as the five voting delegates and their alternates to the Steering Committee are as follows:

Chairman and ORD Program Manager FTS 382-5794	Michael Dellarco
Alternate FTS 629-7870	Gerald Akland
State of Tennessee representative (615) 741-3931	Michael Bruner
Alternate (615) 741-3931	Harold Hodges
Hamilton County representative (615) 757-2123	Howard Roddy
Alternate (615) 757-2521	Steve Meyer
City of Chattanooga representative (615) 867-4321	J. Wayne Cropp
Alternate	Gaines Hobbs
EPA Region 4 representative FTS 250-3136	James Finger

Alternate FTS 257-3043	Winston Smith

Standing nonvoting members of the Steering Committee and their alternates (if any) are the following:

Project Coordinator FTS 629-7870	Robert Jungers
Alternate FTS 545-2208	Shelly Williamson
Office of Toxic Substances FTS 382-3569	Joseph Breen
Alternate FTS 382-3910	Philip Robinson

EMTS MANAGEMENT PLAN

APPENDIX D

SITE CHARACTERISTICS DOCUMENT

This document describes the criteria used in site selection and compares the general characteristics of the selected site, the Chattanooga Standard Metropolitan area, to these criteria. Data used to select the Chattanooga area were readily available from EPA, the Census Bureau, the National Climatic Center, and the Chattanooga Telephone Directory. No measurements or special surveys were conducted during the selection process.

A copy of the full text is normally provided with the EMTS Project Management Plan. Additional copies can be obtained from the Environmental Monitoring Systems Laboratory - Las Vegas.

APPENDIX E

DATA MANAGEMENT FOR EMTS

PART 1. DATA MANAGEMENT

Hardware

The National Computer Center operates three principal data processing facilities: an IBM 3090-200, a Sperry 1100/82, and a minisystems operation consisting of two DEC VAX 11/780's, an IBM 4341, and two PDP 11/70's. The management of the systems is organizationally structured under the National Computer Center, within the Office of Data Processing (ODP) of the EPA Office of Administration and Resources Management (OARM-RTP).

Software

ADABAS is a Data Base Management System (DBMS) developed and supported by Software AG. ADABAS provides system developers with an efficient, flexible, and comprehensive capability for meeting data management requirements for a variety of application environments. EPA has installed the ADABAS data base management system to meet the Agency's central requirements and has designated ADABAS as that Agency's standard DBMS.

ADABAS can access data using multiple keyed selection criteria, supports complex data structures, conserves data base storage space through the use of data compression techniques, provides excellent backup, recovery, and data security facilities, and provides a comprehensive set of utilities to easily accommodate data base structural changes with minimal impact on existing programs. ADABAS can be used in both batch and interactive modes and can interface with application programs written in COBOL, FORTRAN, PL/I, and Assembler languages.

The ADABAS DBMS provides application developers and users with two tools for interaction to application data bases. NATURAL is a nonprocedural language that can provide end users and programmers with the capability of querying, reporting on, and updating ADABAS data bases. It can operate in both batch and online modes. The ADABAS direct call facility provides the

application programmer with a procedural interface to ADABAS.

Statistical software packages also available at the National Computer Center are described as follows:

Statistical Analysis System (SAS)

Statistical Analysis System is an integrated system for data management and statistical analysis. It combines statistics routines, plotting, data manipulation, and report writing capabilities.

SAS has a PL/1-like language which is used to transform or delete variables, create new variables, create new data sets, merge data sets, and print all or part of a data set. SAS accepts data in most forms and can handle many input devices. The system also performs general data manipulation and many statistical functions including the following:

* Linear and nonlinear regression
* Analyses of variance and covariance
* Multivariate analyses of variance
* Matrix manipulation
* Multiple and partial correlation coefficients
* Spearman's and Kendall's correlation coefficients
* Frequency and cross-tabulation tables
* Assorted printed and plotted output

Statistical Package for the Social Sciences (SPSS-X)

The Statistical Package for the Social Sciences is an integrated system of computer programs for the analysis of social science data. In addition to descriptive statistics, simple frequency distributions, and cross-tabulations, the package contains the following:

* Simple correlation
* Partial correlation
* Means and variances for stratified subpopulations
* One-way and n-way analysis of variance
* Multiple regression
* Discriminant analysis
* Scatter diagrams
* Factor analysis
* Canonical correlations
* Guttman scaling

The package has facilities to generate new variables whichare mathematical and/or logical combinations of existing variables, to recode variables, and to sample, select, or weight specified cases.

Economic Software Package (ESP)

The Economic Software Package is a computer language for the statistical analysis of time series by ordinary least squares method or the two-stage least squares method. It is designed to carry out the computational and data processing steps which occur routinely in economic research. ESP is a revised and extended version of an earlier system called TSP (Time Series Processor).

Input to ESP is made through the system's own free format language. ESP features include the following:

* Fitting and extrapolation
* Matrix operation
* Time series plots
* Statistical measures
* Normalized random number generator
* Scatter diagrams
* Exponential trend lines

International Mathematical and Statistical Library (IMSL)

The International Mathematical and Statistical Library is an extensive collection of mathematical and statistical subroutines. Some of the subroutines and their groupings include the following:

* Categorized data analysis
* Eigenvalue analysis
* Forecasting
* Econometrics
* Analysis of experimental design data
* Basic statistics
* Time series analysis
* Generation and testing of random numbers
* Interpolation
* Approximation
* Curve fitting
* Linear algebraic equations
* Sampling
* Utility functions
* Vector and matrix arithmetic
* Linear programming

Biomedical Computer Programs (BMDP)

The Biomedical Computer Programs are a comprehensive and integrated library of statistical programs. These programs may be loosely classified into six series: Data Description,

Frequency Tables, Regression Analysis, Analysis of Variance, Multivariate Analysis, and Special (including nonparametric statistics and cluster analysis).

BMDP offers the user a broad set of descriptive and analytical procedures. These procedures have convenient defaults, offer supplimentary printer graphics, and have thorough, comprehensive documentation. Data grouping or selection may be affected through the control language. The generation of new variables, as well as data modification, can be accomplished through the use of a control language or the inclusion of a FORTRAN subroutine in the BMDP run.

The scope of the program includes the following:

* Univariate statistics (means, skewness) and histograms
* Bivariate F and t tests and comparison of cells
* Scatter plots, probability plots
* Missing values estimates, patterns, and correlations
* Multiple linear, stepwise, best subsets, principal component, and polynomial regression, as well as nonlinear regression
* Analysis of variance of fixed effect or mixed models, with repeated measure and unequal cell size options
* Nonparametric statistical analysis
* Factor analysis, canonical correlation, discriminant analysis
* Cluster analysis on case, variables, or blocks

Data Transmission

The term, data transmission, connotes telecommunications or the transfer of data by electronic signals over wires or via radio waves, but in its broader sense it means to carry data from one place to another. For purposes of this discussion, we will consider the broader meaning which includes "carrying" and "transmitting."

For the development of the EMTS data base there are two data communication needs. One is the need to move data sets which will constitute the EMTS data base. The other is the need to share information about the status of the developing data base. Later in the project, when studies are being planned and conducted at Chattanooga, there may develop a third need to network the data base and GIS to multiple users. Such a development would allow more than one principal investigator at a time to access the GIS from remote work stations.

Of all the EMTS participants who are also sources of data for the data base, only the EPA National Computer Center at RTP has a high quality, 9600 baud, data transmission line to Las Vegas. Even with such a dedicated high speed line, the size of many files precludes its use because of the long times required to transmit them. The RTP-Las Vegas telecommunication system checks for errors, and therefore is very "clean," but magnetic tape can be even cleaner and faster in terms of computer time. The receiver for these transmissions from RTP will be a VAX 11/785, operated by Computer Services Corporation (CSC). The GIS will reside on an identical machine operated by Lockheed. Both VAX computers can have INFO software, allowing the CSC machine to receive data and make tapes for the LEMSCO machine. Tapes would be hand carried from one to the other. If it appears useful, it would be relatively easy to connect the two VAX's via DECNET and a hard wire between adjacent buildings.

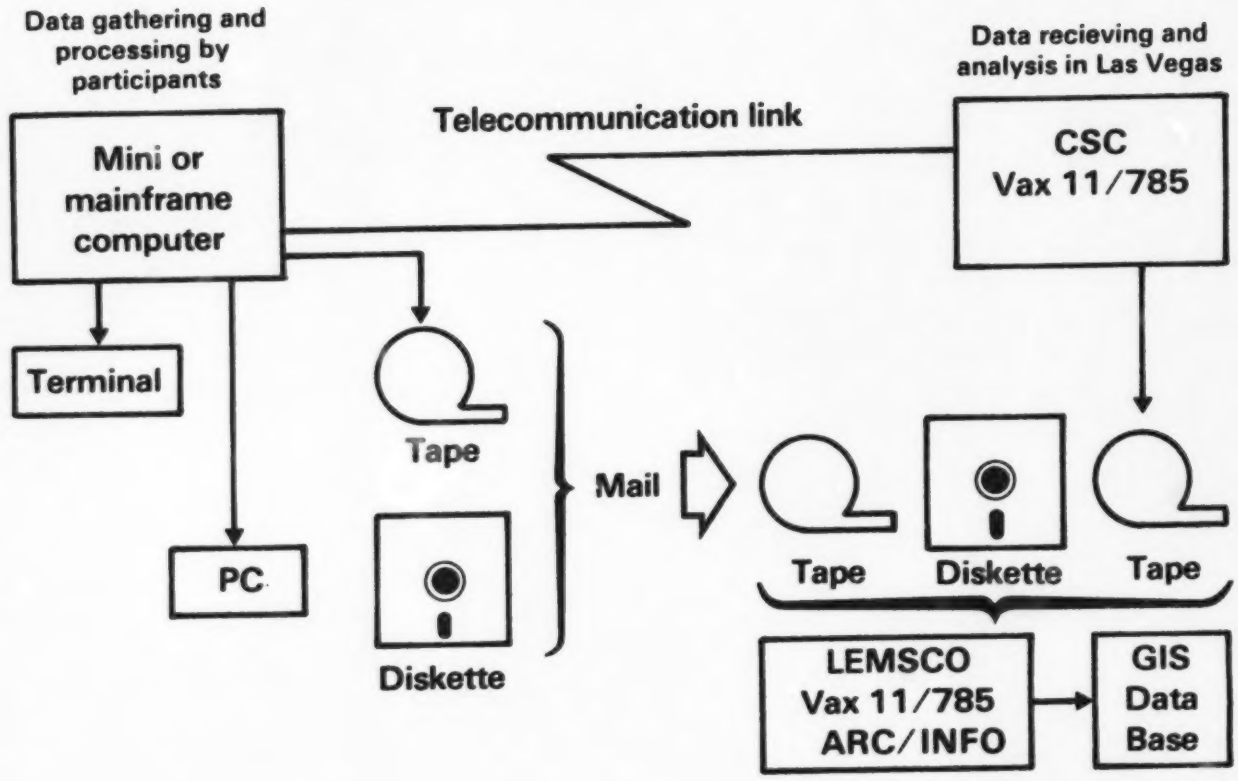
Table E1 presents the various participants, their principal function for data base development, their primary computer equipment, the relevant software, and available modes of data transmission. For the initial effort, mailing well edited tapes is the preferred method for assembling the data base. For distributing information on the status of the data base, floppy disks are proposed.

Figure E1 shows the modes of data transmission being considered for EMTS. The left side of the illustration represents the data equipment at the site of any EMTS participant. Mainframe, mini, and micro computers are included. Because of the availability of PC INFO for the IBM PC XT and AT micros, we suggest its use for entering data not now in digital form. PC INFO can allow the PC to act as a terminal for a mini that has INFO installed, or it can allow the user to create INFO disk files in the PC that can be uploaded to the mini. This capability suggests that participants who have only PC's could create files and mail them as diskettes to Las Vegas where they could be uploaded to the VAX.

Three modes of transmission are depicted in Figure E1: a direct telecommunications link, mailing nine-track magnetic tapes, and mailing two-sided, double density, 5.25-inch diskettes. Direct telecommunication may be available only for RTP, and then only for certain of the smaller files. Tapes and/or diskettes should be available for everyone. The right side of Figure E1 represents the equipment in Las Vegas. Telecommunications are received by the VAX at CSC where a tape is made and carried over to LEMSCO for loading on to their VAX. Alternatively, no tape is made, and the received data are transmitted via DECNET to the LEMSCO VAX. Tapes and diskettes

TABLE E1. EMTS DATA TRANSMISSION CAPABILITIES

Participant	Function	Computer equipment	Software	Transmission modes
OTS	Data gathering	VAX 11/785 PC AT		Tapes Diskettes
NSI (NCC)	Data gathering Data Management	IBM 3090/200 UNIVAC 1100/83 PC-XT	ADABAS	Tapes Modem Diskettes
LEMSCO	Data gathering Data analysis	VAX 11/785 Perkin-Elmer 3210 PC-XT	ETHERNET DECNET ARC/INFO	Tapes Diskettes
TVA	Data gathering	VAX 11/780 Intergraph PC-XT	ELAS	Tapes Diskettes
TDHE	Data gathering	IBM PC-XT	VSPC	Tapes Diskettes
C-HC APCB	Data gathering	Data General PC-XT		Tapes Diskettes
ERC	Quality assurance Cartography	PC-XT PC-AT		Tapes Diskettes
EMSL-LV (CSC)	Data receiver	PDP 11/70 VAX 11/785	HASP	Tapes Modem
REGION 4	Data gathering	PC-AT		Tapes Diskettes



Figures E1. Modes of data transmission.

received in the mail are routed to LEMSCO for uploading to their VAX.

PART 2. GEOGRAPHICAL INFORMATION SYSTEM

This section briefly describes the ARC/INFO GIS in terms of the hardware, software, external supporting systems required, the operators, and the expected outputs.

Hardware

ARC/INFO will be installed on a Digital Equipment Corportion VAX 11/785 mini computer in Las Vegas. This system will be configured as a scientific machine with 3 ports for terminals.

The VAX will have modem capability for access from PC's (microcomputers).

It will be networked to the Perkin-Elmer minicomputer, which shares the same room, via ETHERNET; the two machines will share memory and disk storage. The Perkin-Elmer will be used for airborne scanner imagery data processing, as it is now, and the VAX will be used for large file processing, such as in ARC/INFO. The VAX will have 1.4 gigabytes of fixed disk storage (RU 81 Winchester disk pack) augmented by the Perkin-Elmer's 600 megabytes of user disk space.

The work station for the GIS will be a Tektronix 4125 graphics terminal, and the primary output device will be a 24-inch Versatec plotter. An IBM PC AT will be connected as a terminal and will provide the capability for uploading PC INFO diskette files to the VAX. LEMSCO personnel will be the sole operators of this machine.

Software

The software, ARC/INFO, is a product of ESRI (Environmental Systems Research Institute), Redlands, CA. The following information was taken from the ARC/INFO Users Manual, Version 3, ESRI, January, 1985. Two types of geographic information can be handled by ARC/INFO, cartographic data and thematic data. Cartographic data describe the location of map features and the topological relationships among map features. Thematic data which identify and describe map features are organized in tabular form and are manipulated with a full relational data base management system.

ARC stores the location and topology data of map features for graphic manipulation and display. Three classes of graphic

map features are points (a single x,y coordinate pair), lines (a set of ordered points which are connected), and areas (a closed figure bounded by one or more line features).

Some further terminology is needed to understand the way ARC handles cartographic data.

A coverage is a digital analog of a single map sheet and forms the basic unit of data storage. For purposes of the EMTS Project, the basic map unit will be the 1:24,000-scale, 7.5-minute quadrangle in Universal Transverse Mercator (UTM) projection. A coverage may have several classes of features. Arcs represent line features and borders of area features. One line may be made up of many arcs. Arcs can be topologically linked to their endpoints (nodes) or to the areas (polygons) on each side of them. Nodes represent arc endpoints and intersections of line features. A node may be topologically linked to the arcs which meet at the node. Polygons represent area features. A polygon is defined topologically by a series of arcs which compose its border and by one or more label points inside its border. Label points represent point features. They are also used to associate attributes with polygons or to position text within polygons. In this case, label points are topologically linked to the surrounding polygon.

Thematic data are handled by INFO, a product of Henco Software, Inc., Waltham, MA. INFO is a relational data base management system which stores the attribute data related to the map features in ARC. ARC creates attribute tables, accessible to INFO, for each class of coverage feature. A set of attribute files is created for each coverage. Attribute files store the topological information for the feature. For example, an attribute table for arc features in a coverage includes the arc's internal number (machine assigned), the user ID number (assigned by user), the internal number of the beginning node, the internal number of the ending node, the internal number of the polygon (if any) on the arc's left side, the internal number of the polygon (if any) on the arc's right side, and the length of the arc.

Through the power of the relational data base structure, other attributes of the coverage features also may be stored, such as population, air quality concentrations, or soil type. Thus, ARC manipulates the cartographic elements to overlay coverages or to merge contiguous coverages, while INFO provides the related attributes. The attributes can be displayed graphically as labels or colors on the resulting map.

External Supporting Systems

In its broadest terms, the GIS includes, in addition to the VAX and ARC/INFO, all of the equipment and data files which contribute to the data base. Although the analytical system is in Las Vegas, the information system extends to all the EMTS participants. The participants and their equipment are listed in Table E1. The point to be made here is that the EMTS GIS is not an isolated device, but a network of cooperating entities which are contributing, not only data, but the resources of equipment and personnel.

Outputs

Output from ARC/INFO primarily will be computer graphics-generated maps resulting from some analysis of selected data sets in the EMTS data library (see Quality Control and Tracking System in Section V for discussion of data library). The first outputs will be from demonstration runs to test the newly installed system and to validate each file (coverage) as it is added to the GIS data base. When enough coverages are assembled to demonstrate the analytical capabilities of ARC/INFO, a series of outputs will be produced to illustrate the planned EMTS User's Guide.

APPENDIX F.

INVENTORY FILE FOR EMTS PROJECT

Documentation for the automated EMTS Inventory Questionnaire Version 2.0 is included as part of this project management plan. The documentation describes the structure of the inventory file.

APPENDIX G

GUIDANCE FOR PREPARING STUDY PLANS

The EMTS Steering Committee, which is responsible for approving studies to be conducted at EMTS, must be convinced that the study is relevant to the overall objectives of the EMTS Project, and that the quality of the resulting data or information will be comparable to other measurements in the data base characterizing the EMTS. To that end, minimum requirements for the contents and format of study plans describing the work to be done are specified in this section.

An outline of the required elements of an approvable study plan is presented below:

Background

Summarize briefly what has been done previously and the need for this study. State how the EMTS environment and/or the GIS could help the study.

Objective

Clearly state the objective or objectives of the study. In particular the required data quality objectives, i.e., the limits of acceptable error, must be clearly specified.

Rationale

State the reason why the study is proposed. Cite the specific underlying Public Law or regulation that the study will support.

Methods and Procedures

Identify the number, type, location, and frequency of samples or measurements. Indicate methods and procedures for sampling and then preparing and analyzing samples either by references or in detail if no adequate references are available. Describe the experimental design, statistical procedures to be used, and methods for data analysis.

Quality Assurance

Present a detailed QA/QC plan to show clearly how all aspects of the study, from sampling through analysis to data interpretation will be kept within prescribed limits of error.

Results

Describe in detail the format and data storage medium whereby results will be presented. This should include as minimum: type of sample, location and time of sampling, and analytical results in appropriate units. Describe how presentation of QA/QC results will be presented.

Evaluation and Interpretation of Data

Explain in detail how the data will be evaluated and include a summary of any statistical procedures which will be used.

Management and Funding

Identify the principal investigator and other personnel involved in the study and give their credentials. Describe the details of the budget and give the funding source.

Schedule with Identified Products

Present a schedule showing as a minimum when the study will begin and end, when validated data will be made available to the EMTS, and when the final report will be available.

Resource Requirements

Identify any additional resources not already mentioned in Management and Funding which may be required, especially those which might be contributed by other EMTS participants, or which may impact the local community.

Communications Strategy

Identify one spokesperson for the study group. Describe any planned public information program to explain the study and its purposes to the local citizenry.